1.a. (10 points) Let $f(x) = x^2 + 4x + 1$, and let $g(x)$ be the inverse of $f(x)$, defined on $[-2, \infty)$. Compute $g'(6)$.

1.b. (10 points) Compute the derivative of $\cos^{-1}(x)$ at $x = \frac{\sqrt{2}}{2}$.

2.a. (10 points) Suppose that you create an annuity with an initial investment of $P(0) = 10000$, an interest rate of $r = .1$, and a continuous withdrawal of $N = 5000$ per year. When does the annuity run out of money?

2.b. (10 points) What is the minimal initial investment so that the annuity never runs out of money?

3. (20 points) Compute

$$\lim_{t \to \infty} \frac{\ln(t + 2)}{\log_2 t}.$$ 

4. (20 points) Compute the indefinite integral

$$\int 2^x \cos x \, dx.$$ 

5. (20 points) Compute the indefinite integral

$$\int \sqrt{x^2 + 9} \, dx.$$